

Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Chemical Effects in Solution on the Formation of Film Morphology in Bulk Heterojunction Organic Solar Cells JONG KUK KOH, WON TAE CHOI, KOOKHEON CHAR, Seoul National University — A novel method to control the active layer morphology of bulk heterojunction(BHJ) organic solar cells will be presented in this study. The effect of solvent quality, chemical effect in solution, on the morphology of poly(3-hexylthiophene) (P3HT):phenyl-C61-butyric acid methyl ester (PCBM) active layer has been investigated. The solubility of solvent can be controlled by mixing other types of additional solvents (additives) to the P3HT:PCBM blend solution, which could adjust the association and/or solvation characteristics for both P3HT and PCBM solutes in mixed solvents. As a result, the control over the solubility has a definitive effect on the film morphology. We report a new additive, 2-chlorophenol, which could drive P3HT to have more association character and, PCBM to have more solvation character in the mixed solvent. Higher P3HT crystallinity was achieved due to more association character in the presence of 2-chlorophenol. Also, the higher solvation character of PCBM leads to the reduced size of PCBM agglomerates, as confirmed by SANS measurements. Based on these results, P3HT:PCBM BHJ solar cell devices were fabricated, with maximum power conversion efficiency of 3.24%, which is 43% enhancement when compared with the reference.

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Date submitted: 07 Nov 2012

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